



HOW TO... Use Excel's financial functions

Keep saying you should organise your savings? Janet Swift's guide to tracking investments will help you put your money where your mouth is

The idea of borrowing money at a specified rate of interest or earning interest on an investment is something with which we are all familiar. Interest is expressed as a percentage, but it also has a time-based component. Interest is calculated and paid at regular intervals. This makes its behaviour rather more complex than a simple, one-off percentage.

Interest is a percentage of the total sum per time period: so many per cent per month, so many per cent per year, or whatever. It is a rate in the sense that it involves the passage of time – miles per hour, kilometres per second and 10 per cent per month are all rates. But 10 per cent per month is very different to 10 per cent per annum. Therefore, converting between interests quoted for different time periods is something we will need to understand.

We also need to understand the terminology and conventions used. The present value, PV, is the term used for the sum of money involved at the start of a loan or investment. The future value, or FV, is the final amount. In other words, FV is what you get after interest has acted on PV. This jargon

applies equally to investments or loans. So with an investment, the amount of money that is deposited or invested is the PV and the final balance is the FV. But with a loan, the sum borrowed is the PV and the balance after a series of payments is made is the FV. In all cases, cash paid out is negative and cash paid in is positive. In the case of an investment, the cash flow out is negative but its future value is positive.

1 We'll start with payment, or PMT, which is one of the simplest of the financial functions. Suppose you want to borrow £8,000 over a period of five years at an interest rate of 6.9 per cent. How much will you have to repay every month? To find out, first type the labels Amount in A3, Years in A4, Interest rate in A5, and Monthly payment in A6. Enter the values £8,000 in B3, 5 in B4 and 6.9% in B5. This will probably display as 6.90% so, if you wish, click the Decrease Decimal button in the formatting toolbar to remove the unwanted zero. Equally, if the spreadsheet displays 7%, click the Increase Decimal button.

UNDERSTANDING PRESENT AND FUTURE VALUES

It isn't difficult to get to grips with future and present values of a cash flow. Just keep in mind what is happening to all the money involved and, in particular, what is earning interest.

Let's say you have a cash flow of £10 per year for 10 years, paid at the end of each year, and assume an interest rate of five per cent. After the first year, you have £10. At the end of the second year you have the original £10, five per cent interest on it, plus the next payment, making £20.50. Continue this pattern, adding interest to the deposit and another £10 payment, and after 10 years you have £125.78. This is the cash flow's future value. In Excel, it's given by FV(5%,10,10).

The cash flow's present value is the lump sum that must be invested now to arrive at the future value of £125.78 if left to accrue interest at five per cent and for 10 years. This is given by PV(5%,10,10), and comes to £77.22. The cash flow that will grow to be worth £125.78 is only equivalent to having £77.22 now because of the 10-year wait involved.

2 Place the cursor in B6 but, rather than typing anything in the Formula Bar, click the Insert Function icon to its immediate left (with an fx icon). In the dialog box that appears, click the drop-down menu called 'Or select a category' and choose Financial. Then scroll through the options to find PMT and click OK.

3 The Function Arguments box lets you point to the cells that you want to include. However, some typing is still required. Select the Rate box and click on B5. Then, to convert it from an annual interest rate to a monthly one, type /12. The value that appears on the right should be 0.00575. Move to the next box, Nper (number of periods), using the mouse or by pressing the Tab key. Then click on or type B4. This value you

1 Financial functions
2 Loans
3 Amount £8,000
4 Years 5
5 Interest rate 6.90%
6 Monthly payment

2 Insert Function dialog box showing 'Financial' selected.

3 Function Arguments dialog box for PMT. Rate: B5/12, Nper: B4, Pv: B3, Fv: 0, Type: 0.

4 Completed PMT formula in cell B6: `=PMT(B5/12,B4,B3,0,0)`

5 Savings functions
2 Amount £5,000
3 Years 2
4 Interest rate 5.45%
5 Monthly deposit -£196.76
6 Existing savings -£2000

6 Function Arguments dialog box for PMT. Rate: D5/12, Nper: D4, Pv: D3, Fv: 0, Type: 0.

need to convert from years to months by multiplying by 12, so type *12 on the same line. Move to the Pv (present value) box and click on B3, the amount you want to borrow. At this point, the formula on the entry line reads =PMT(B5/12,B4*12,B3) and the result of the formula has appeared at the bottom of the dialog box. Click OK. The amount of the monthly payment displays in red, signifying that it is a negative amount and something you have to pay out.

4 The PMT function is also a useful tool if you're interested in saving rather than borrowing. Suppose you want to have saved £3,000 in two years' time and you can get a fixed interest rate of 5.45 per cent for making regular monthly deposits. Copy the labels in A3:A6 to C3:C6 and then change 'Monthly payment' to 'Monthly deposit' in C6. Enter £3,000 into D3, 2 into D4 and 5.45% into D5. Start the formula in D6 by typing =PMT(and then click the Insert Function icon.

When the Function Arguments box opens, click on D5 to place it in the Rate box, then type /12 to convert from the annual rate to a monthly one. Tab to the next box, Nper, click on D4 then type *12 to convert from years to months. Skip over the next box, Pv, and when you get to the Fv box click on D3. Finally, enter 1 in the Type box – which signifies that the savings deposit is made at the beginning of each month – and then click OK. The resulting figure of -£118.06 tells you that you will need to deposit £118.06 each month to make sure you have saved £3,000 after two years.

5 Suppose you have already saved £2,000 and want to achieve £5,000 at the end of two years. What monthly deposit do you need to make? Enter the label Existing savings in C7 and put 2,000 in D7. As this is effectively another deposit, it needs to be a negative value. Type in the minus sign before it and use cell formatting to display it in currency format in red as well as with the minus sign.

6 Change the value in D3 to 5,000. Edit the PMT formula by placing the cursor in D6 and clicking the Insert Function icon to reopen the Function Arguments box. Go to the Pv box and click on D7, then click OK. Now you only have to save £109.02 a month instead of £118.06.

7 You decide to round down your monthly deposit to £100. What effect will this have? Another financial function, FV, lets us investigate this. Type the value -100 into D6, remembering the minus sign to indicate a payment made out. Then place the cursor in D3 and click the Insert Function icon. Select the category Financial and choose FV from the list and click OK. Alternatively, type =FV before clicking the icon. The entries you need to make in the Rate and Nper box are the same as in Step 4. This time, however, you click on D6 for the Pmt box and D7 for the Pv box and type 1 in the Type box.

8 There's going to be quite a shortfall if you only save £100 per month. What rate of interest would be required to make up for it? We can find out using the Goal seek tool. Place the cursor in D3, the cell containing the FV formula, and click the Tools menu. You will probably have to click the chevron at the bottom of the list that shows the full menu to find Goal Seek. Select it, and when the Goal Seek box opens type the desired value, 5,000, in the 'To value' box. Then move to the 'By changing cell' box and click on D5. Click OK, and the rather unrealistic interest rate of 8.45 per cent will appear.

9 Let's see how Excel tackles the more difficult challenge of deciding whether it is worth purchasing an annuity. The function involved is PV, the present value of a total series of future payments. The annuity costs £50,000, so enter Purchase price in E3 and -£50,000 in F3; remember that it has to be negative because it is cash you are paying out. It will pay £500 per month so enter Monthly Income in E6 and £500 in F6.

Enter Interest Rate in E5 and 5% in F6 as a reasonable value of the prevailing rate of interest. Enter Years in E4 and 10 as an initial value in F4. Then type Value into E7 and calculate the value of the annuity in F7 using the PV function. The arguments you want are F5/12 in the Rate box, F4*12 in Nper and F6 in Pmt.

10 When you press OK, the value of the annuity is shown as negative because this is the amount of money you would now have to put into a bank account (at the assumed interest rate) to fund the same £500 monthly payments that the annuity would pay you.

The value of £47,140 is less than the purchase price. The difference can be calculated with a formula that subtracts the present value of the income received as a cash flow from the cost of the annuity. Type Difference into E8 and =F3-F7 into F8. However, the period over which it is paid is a variable element. An annuity is normally paid for the rest of your life, so what happens as you vary the value for years in F4? To find out, select cell F8 and open the Scenario Manager dialog box from the Tools menu.

11 We want to devise four possible scenarios. Here, we show the first one being set up. Click Add in the Scenario Manager, type the Scenario name Shorter (5 years) and enter F4 in the Changing cells box, then click OK. In the next dialog box, enter 5 as the value. Repeat with three more scenarios: Slightly longer (12 years), Longer (15 years) and Even longer (20 years). Then click Summary and ensure that F8 is entered in the 'Result cells' box.

12 The Scenario Summary is created on its own page in the spreadsheet and it shows that your gamble will pay off if you are paid the annuity for 12 years. Furthermore, you will do very well indeed if the annuity is paid for 20 years. However, it is a bad buy in the Shorter (5 years) scenario. **ES**

